

INL Geocentrifuge Research Laboratory

The Geocentrifuge Research Laboratory at the Department of Energy's Idaho National Laboratory was established to provide important environmental, geotechnical, energy, and national defense research for the nation.

The centerpiece of the laboratory is a 2-m geocentrifuge. The centrifuge has a 50 g-ton capacity, and is capable of spinning a sample as large as 70 cm long by 50 cm thick by 60 cm high.

The geocentrifuge subjects an experimental sample to a high-acceleration field by spinning it rapidly around a central shaft. When the geocentrifuge is spinning at 260 revolutions per minute, it is capable of applying up to 130 times the force of earth's gravity on an experimental sample.

In this centrifugal field, fluid flow occurs much more rapidly using the geocentrifuge technique, allowing researchers to study in just a few weeks, the effects of tens of years of gravity-induced fluid movement.

The geocentrifuge is constructed with an asymmetrical beam arm and pendulum swinging basket that rotates within a steel and concrete enclosure, ensuring both safety and aerodynamic efficiency during operation. An automatic balancing system compensates for changes in the center mass during operation – a feature

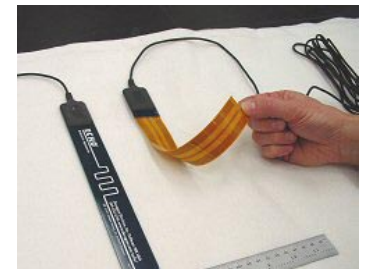
that is particularly useful in many environmental geocentrifuge applications involving fluid movement.

INL researchers use the geocentrifuge to perform work such as:

- Evaluating engineered caps and barriers
- Conducting unsaturated flow and transport experiments
- Improving characterization of contaminated sites
- Testing new geophysical tools.

New tools are being developed to conduct accelerated research experiments in the INL geocentrifuge. Not only must these tools collect information more rapidly than traditional laboratory experiments, they also must withstand high centrifugal force while the geocentrifuge is spinning. Tool designs to monitor experiments while they are in flight include new moisture content sensors, modified soil testing columns, fluid sampling apparatus, and geophysical tomographic techniques.

INL model c-61 geotechnical centrifuge system (50-g ton, 2-m radius).



New flexible moisture content probe design.

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For more information

Earl D. Mattson, Ph.D.
Lead Researcher
(208) 526-4084
Earl.Mattson@inl.gov

Mark D. Ankeny, Ph.D.
Manager, Geosciences
Research
(208) 526-5748
Mark.Ankeny@inl.gov

INL Geocentrifuge Research
Laboratory web site:
<http://www.inl.gov/centrifuge/>

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Experimental setup using the INL geocentrifuge.

Experimental control and monitoring are accomplished by using a computer mounted on the geocentrifuge. This ability allows for greater experimental control of geocentrifuge tests than is possible on smaller centrifuges and allow in-flight collection of monitoring data. Data transmission from the geocentrifuge computer to the control room occurs in real time, allowing the researchers to evaluate the results of their experiments while tests are in progress.

New numerical models have been developed with university collaborators to analyze experimental data from the geocentrifuge. These models include modified versions of HYDRUS 1- and 2-D that account for the applied centrifugal force. The models are used to both design geocentrifuge experiments and to estimate parameters from outflow and tracer experiments.

The Geocentrifuge Research Laboratory is available for use by guest scientists, allowing personnel from other institutions and laboratories to perform research to test their scientific and engineering hypotheses. Guest and visiting researchers are encouraged to contact INL scientists for collaboration opportunities using this facility.

